

### REMARKS

Claims 4, 5, 7, and 14 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Claims 1-6 and 8-17 have been rejected under 35 U.S.C. §101 because the claimed invention as a whole fails to provide a useful, concrete, and tangible result.

Claims 1-17 have been rejected under 35 U.S.C. §103(a) as being unpatentable over the admitted prior art of U.S. Patent Application Publication No.: 2002/0087590 to David Francis Bacon et. al. ("Bacon") in view of U.S. Patent No. 6,338,159 William Preston Alexander, III et al. ("Alexander").

Claims 1-17 remain pending.

#### Rejection of claims 4, 5, 7, and 14 under 35 U.S.C. §112, second paragraph

With respect to claim 4, the Office Action states that the word "it" lacks positive antecedent basis and renders the claim indefinite.

Applicant has amended claim 4 by replacing the "it" with the recitation "the second object".

With respect to claim 5, the Office Action states that the word "it" lacks positive antecedent basis and renders the claim indefinite.

Applicant has amended claim 5 by replacing the "it" with the recitation "the second object".

With respect to claim 7, the Office Action states the phrase "the objects processed " lacks positive antecedent basis and renders the claim indefinite.

Applicant has amended claim 1 to provide proper antecedent basis.

With respect to claim 14, the Office Action states that the phrase "any valid depth value" fails to particularly point out and distinctly claim the subject matter in such a way that allows one of ordinary skill in the art to make and use the claimed invention. Specifically, the Office Actions states that word "any" is indefinite.

Applicant has amended claim 14 to replace the word "any" with the word "a".

Applicant submits that these rejections have been overcome.

Rejection of claims 1-6 and 8-17 under 35 U.S.C. §101

The Office Action states that claims 1, 16, and 17 describe determining if an object might be garbage (i.e., "identifying which of the plurality of objects are to be processed to determine whether or not they are garbage"). The Office Action further states that determining if something might happen is not indicative of a tangible result. The Office Action still further states that clear and precise steps need to be given in order to show a tangible result.

The Office Action also states that claim 16 does not specify that the computer program product is embodied on a computer readable media.

The Office Action still further states that claims 2-6 and 8-15 either contain or inherit the deficiencies of claim 1.

Applicant has amended claims 1, 16, and 17 to recite clear and precise steps by the step "identifying which of the plurality of objects are to be processed to determine whether or not

they are garbage” to read “identifying which of the plurality of objects are processed to determine whether or not they are garbage”.

Applicant has further amended claim 16 to recite a program storage device readable by a machine in proper Beauregard claim format.

Applicant has amended claim 3 to remove a similar deficiency. Claims 2, 4-6, and 8-15 inherited the deficiencies from claim 1 and therefore no longer contain such deficiencies in light of the amendment made to claim 1.

Applicant submits that these rejections have been overcome.

Rejection of claims 1-17 under 35 U.S.C. §103(a)

With respect to independent claim 1, the Office Action states that the combination of Bacon and Alexander teaches all of Applicant’s recited elements.

Bacon teaches techniques that allow concurrent collection of cyclic garbage on reference counting systems. Candidate objects are found that may be part of cyclic garbage. Each candidate object has a reference count. Two tests are performed to determine if concurrent operations have affected the reference counts of the candidate objects. If concurrent operations have not affected the reference counts, the candidate objects are collected as garbage. Additionally, during garbage collection, the decrements to reference counts are delayed so that increments occur before decrements and so that decrements are held a predetermined time before being applied. This prevents decrementing a reference count and collecting a cycle as garbage right before a reference is added to an object in the cycle.

As admitted by the Examiner, Bacon does not teach or suggest maintaining a depth value based on a distance from a global object data, and identifying, based on the associated depth

value, which of the plurality of objects are to be processed to determine whether or not they are garbage.

Alexander teaches a system and method for representing program event trace information in a way, which supports a variety of queries regarding system performance. The tracing and reduction of the system and method may be dynamic, in which case information is obtained and added to the trace representation in real-time. Alternately, the tracing and reduction may be static, in which case a trace text file or binary file is obtained from a trace buffer, and the reduction takes place using the trace file as input. The trace information, whether obtained statically or dynamically, is represented as a tree of events. The system and method may be used to present many types of trace information in a compact manner, which supports performance queries. For example, the tree structure may reflect the call stacks observed during a program's execution, and statistics regarding the memory allocated/deallocated in the various routines and call stacks may be stored at each node of the tree. The tree structure may be used to store performance information regarding Java bytecodes executed, memory allocated, or other types of performance information.

In contrast, Applicants' invention recites a garbage collecting method for a memory resource in a computer system. The method includes, for each of a plurality of objects in the memory resource, maintaining a reference count based on a number of objects pointing thereto, and maintaining a depth value based on a distance from a global data object. The method further includes identifying, based on the associated reference count and depth value, which of the plurality of objects are processed to determine whether or not they are garbage.

The Examiner cites col. 5, lines 24-27 and Figs. 4-5 of Alexander as allegedly teaching maintaining a depth value based on a distance from a global object data, and identifying, based

on the associated depth value, which of the plurality of objects are to be processed to determine whether or not they are garbage. Applicant submits that the cited passages have been misinterpreted.

The purpose of the system and method taught by Alexander is to provide trace information to a developer or systems manager in a compact and efficient manner, and to provide trace information in such a way to facilitate understanding of the system's operation. Fig. 3 of Alexander shows a portion of a trace sequence, along with the state of the call stack after each trace event. The trace text file is created based on information contained in a trace buffer (col. 4, lines 19-31. Fig. 4, which was cited by the Examiner, is an event tree, which reflects call stacks observed during system execution. At each node in the tree, several statistics are recorded. The particular statistics shown include the number of distinct times the call stack is produced, the sum of the time spent in the call stack, the total time spent in the call stack plus the time in those call stacks invoked from this call stack, and the number of instances of this routine above this instance (col. 4, lines 37-47).

The tree structure shown in Fig. 4 of Alexander depicts one way in which data maybe be pictorially presented to a user. The same data may also be presented to a user in tabular form as shown in Fig. 5 of Alexander (col. 5, lines 18-21).

The cited passages at col. 5, lines 24-27 only teach that Table 5 includes columns of data for Level, RL, Calls, Base, Cum, and Indent, and that the Level is the tree level (counting from the root as level 0) of the node. Each node can be traced back to only one root. In other words, no node is a child of two separate roots. Further, the Level (level of the node in the tree) is not used to determine anything.

In contrast, Applicant's invention teaches the depth value of an object as the distance of the object from a global data object (the object's position in a reference chain) (See paragraph 0030 of the specification). The object can also be referred to by multiple global data objects (See Fig. 2B), and/or be part of, and have different positions in, different reference chains (See Fig. 2B), unlike a node level in a tree (as taught by Alexander). The object can also be referred to by a subsequent object in the reference chain (See Fig. 3F). The depth level of Applicant's invention can have a value of 1 to 3, or be uninitialized. If an object in a reference chain has a depth value of 3, a subsequent object in the reference chain will have a depth value of 1, not 4 (See Fig. 2F and paragraph 0034), unlike the node level taught by Alexander. An object is identified for processing by a garbage collector to determine with finality whether the object is garbage when it is determined that a second object previously pointing to the first object is no longer pointing to the first object, and the depth value of the second object is one less than the depth value of the first object. The node level taught by Alexander is not used in any such determination.

It is clear that the level of the node taught by Alexander is not at all similar to the depth value recited in Applicant's independent claim 1. Therefore, Alexander does not teach or suggest maintaining a depth value based on a distance from a global object data, and identifying, based on the associated depth value, which of the plurality of objects are to be processed to determine whether or not they are garbage.

The Examiner states that it would have been obvious to one skilled in the art at the time of the invention to modify the teachings of Bacon with the teaching of Alexander. Bacon discloses techniques for concurrent collection of cyclic garbage in reference counting systems and Alexander discloses a system and method for providing trace information. There is nothing

taught or suggested in either references that creates a motivation to combine the references. The Examiner cannot base obviousness upon what a person skilled in the art could, or might, try but rather must consider what the prior art would have led a person skilled in the art to do. In re Antonie, 559 F.2d 618 195 USPQ 6 (CCPA, 1977). To prevent the use of hindsight based on the invention to defeat patentability of the invention, the Examiner must show a motivation to combine the references that create the case of obviousness. In re Rouffet, 47 USPQ2d 1453 (Fed. Cir., July 15, 1998). The conclusion asserted by the Examiner represents an impermissible use of hindsight gained from the present invention.

In view of the foregoing, it is respectfully submitted that Bacon and Alexander, whether taken alone or in combination, do not teach or suggest the subject matter recited in Applicant's independent claim 1. Specifically, the references do not teach or suggest a garbage collecting method for a memory resource in a computer system including, for each of a plurality of objects in the memory resource, maintaining a reference count based on a number of objects pointing thereto, and maintaining a depth value based on a distance from a global data object, and identifying, based on the associated reference count and depth value, which of the plurality of objects are processed to determine whether or not they are garbage.


Claims 2-15, which depend directly or indirectly from the independent claim 1, incorporate all of the limitations of claim 1 and are therefore patentably distinct over Bacon and Alexander for at least those reasons provided for independent claim 1.

Independent claims 16 and 17 recite limitations similar to those recited in independent claim 1, and are therefore patentably distinct over Bacon and Alexander for at least those reasons provided for independent claim 1.

Conclusion

In view of the foregoing, Applicant respectfully requests reconsideration, withdrawal of all rejections, and allowance of all pending claims in due course.

Respectfully submitted,

  
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